What is NIST

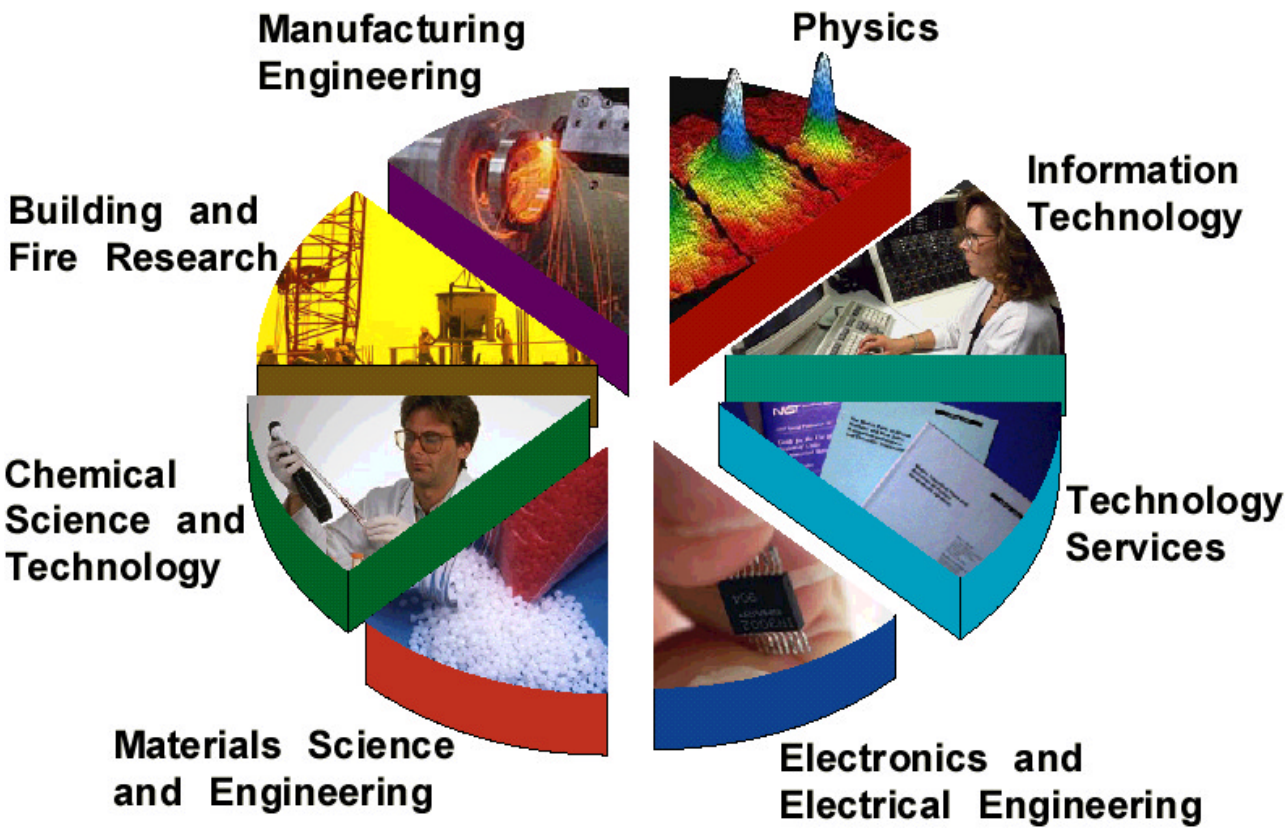
NIST's primary mission is to promote economic growth by working with industry to develop and apply technology, measurements and standards.

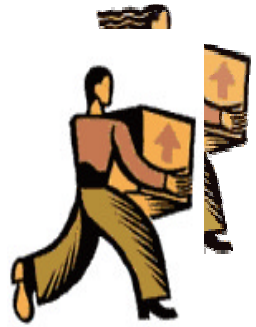
Helping America Measure Up

- NIST strengthens the U.S. economy and improves the quality of life by working with industry to develop and apply technology, measurements, and standards.

- NIST Assets:
  - 3,300 employees
  - $800 million annual budget
  - 1,200 industrial partners
  - 2,000 field agents
  - 1,550 guest researchers
  - $1.4 billion co-funding of industry R&D
  - National measurement standards

National Institute of Standards and Technology - Program Portfolio





ATP ADVANCED TECHNOLOGY PROGRAM

Highly leveraged measurement and research capabilities supporting trillions of dollars in products and services

Why NIST?

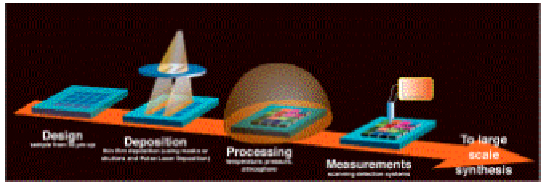
- **Drivers for industry**
  - Speed, responsiveness, innovation
  - Reduction in time, material, and waste
  - Optimization for new materials needs
- **Drivers for NIST**
  - Rapid development of materials data
  - Validation of combinatorial measurements
  - Connections to fundamental science

Agenda for Today's Workshop

AGENDA FOR NIST COMBINATORIAL METHODS CENTER
KICK-OFF MEETING, JANUARY 23, 2002, SAN DIEGO

7:30	Registration and Coffee
8:30	*Welcome and Introductions* – Eric Amis
8:50	*Combinatorial Adhesion* – Alfred Crosby
9:10	*Multispectral Imaging for Materials Analysis* – Steven Buntin
9:30	*High-throughput Transport and Diffusion* - Chris Muzny
9:50	*Multiscale Patterned Biosurfaces* – Eric Amis
10:10	Coffee Break
10:30	*Combinatorial Tools for Inorganic Materials* – Debra Kaiser
10:50	*Polymer Formulations* – Alamgir Karim
11:10	*High-throughput Flame Retardants* – Jeffrey Gilman
11:30	*Combinatorial Polymer Crystallization* – Kathryn Beers
11:50	*Other Current Topics* –Alamgir Karim
12:10	Lunch
1:15	*Center Organization* (Projects, Costs, Benefits) –Eric Amis
	Participating Membership Level
	Focused Projects
	CRADA's

Combinatorial Methods at NIST



Polymers

Polymer blend phase behavior

Biocompatibility assay

Adhesives

Surface chemistry and modification

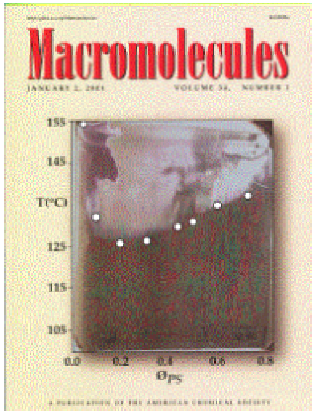
Semi-crystalline polymers

Block-copolymer ordering behavior

Fire retardants

Library production support

Laser scanning microscopy



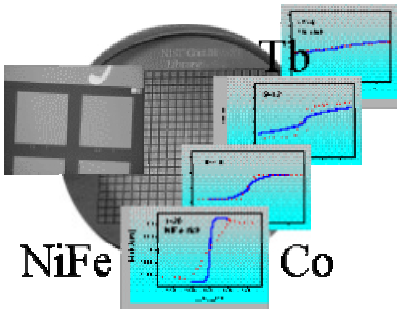
Metals and alloys

Dielectric oxide thin films

Metallization of GaN semiconductors

TEM studies of combinatorial libraries

Polarized light scattering



Biomaterials

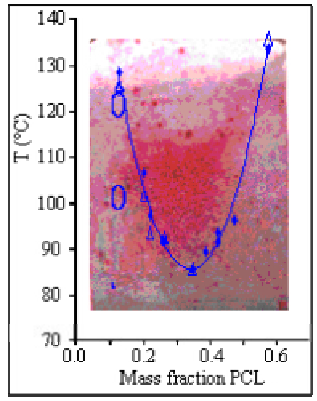
Biocompatibility assay

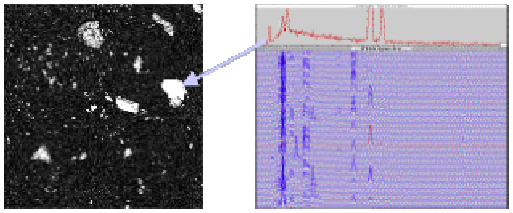
Surface Hydrophobicity

Bio-adhesion

Cell growth and differentiation

Patterned cellular activity





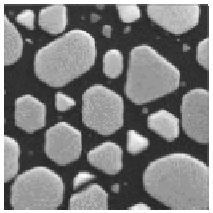
Chemical Analysis

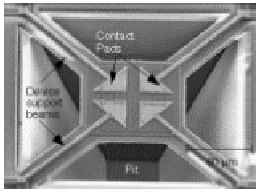
Chemical microscopy by SIMS

Data mining: Searching for patterns

Quantitative spectral imaging

Infrared chemical imaging



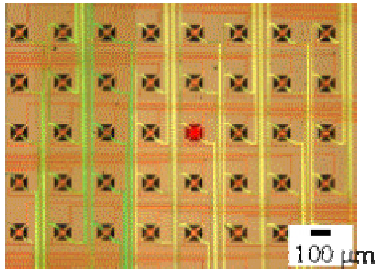


Thermal Properties

Service life prediction

Microhotplate array platforms

Modeling and characterization



Assessing Needs and Initiation

Visitors to NIST Combi labs

Air Products, Army Research Lab, Asahi Chemical, BASF, Bayer, Dow Chemical, Dow Corning, ExxonMobil, GE, Pall Corporation, Rhodia, Rohm & Haas, TotalFinaElf, Wright-Patterson

Key Findings from NIST Vision 2020 Workshop

- US industry slow to adopt “combi” compared to Europe
- No coordination for industry/government/academia to collaborate
- Combi must be extended to more complex systems
- Cost of combi must be reduced
- *Priority for NIST to facilitate methodology and standards*

Leadership roles for NIST labs

- Symposium on “Combinatorial and Artificial Intelligence Methods in Materials Science” for Fall 2001 Materials Research Society National Meeting (69 papers over 3.5 days)
- Special focus issue on “Combinatorial and High-Throughput Methods for Materials Science” as the April 2002 issue of the *Bulletin of the Materials Research Society*
- Founding of new Gordon Research Conference on “Combinatorial and High-Throughput Methods for Materials Science” to be held June 30-July 4, 2002
- Several edited monographs and encyclopedia entries in preparation to collect insights from early adopters

NCMC Kick-Off

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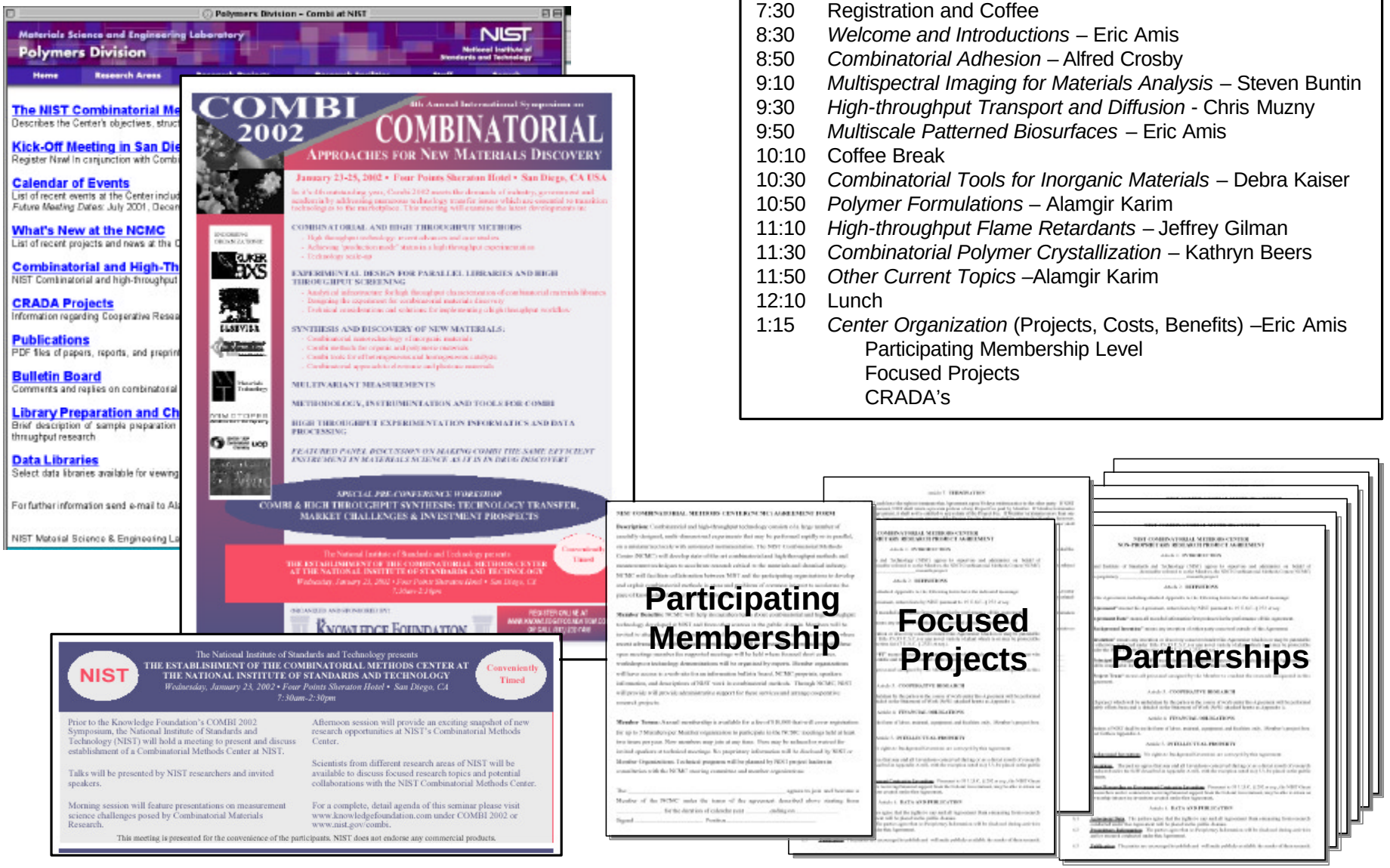


NIST Combinatorial Methods Center, NCMC

NCMC Objectives

Promote dissemination of information on combinatorial measurement methods

Provide coordinated outreach for NIST-MSL research activities that support combinatorial methods

Participating Membership

Focused Projects

Partner Memberships

Industry

Academia

National Laboratories

An administrative portal for industrial interactions

NIST Combinatorial Methods Center, NCMC

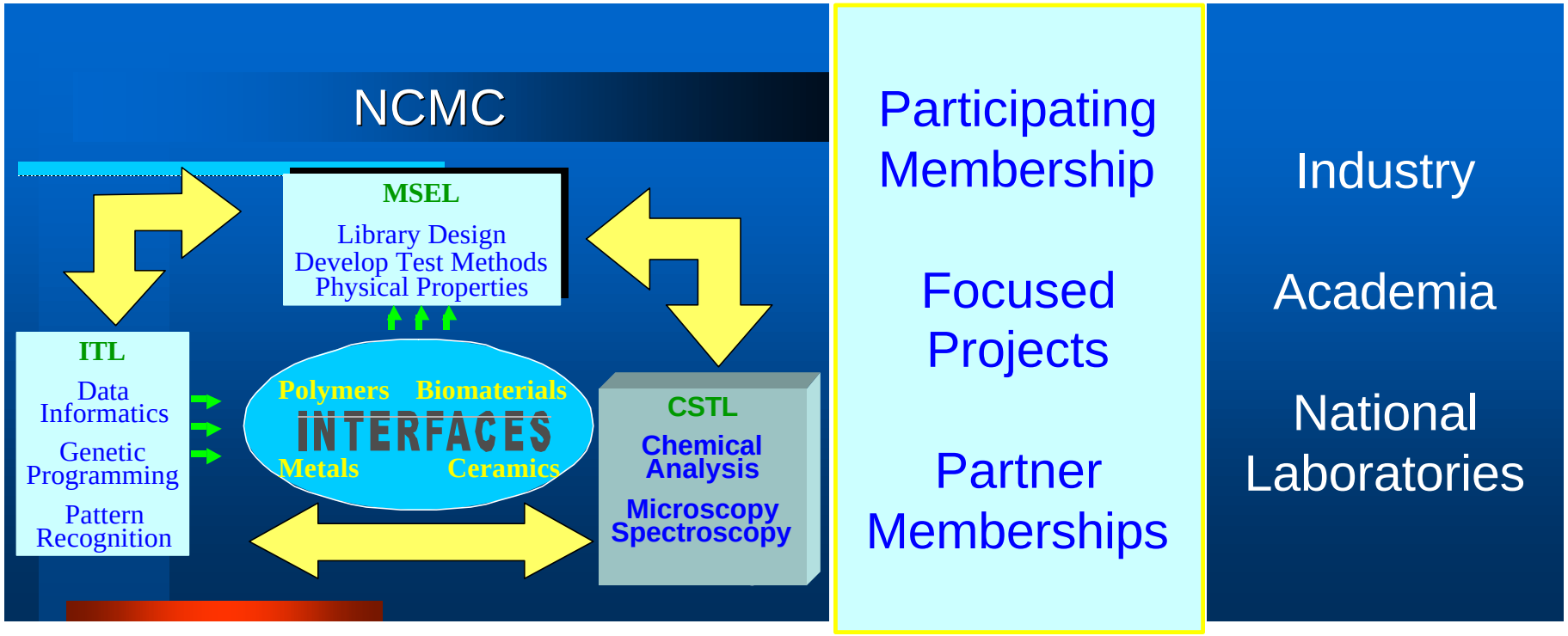
Promote dissemination of information on combinatorial measurement methods for materials science between industry, university, and national laboratories

- **Participating Membership**
  - Technical meetings presenting work on combinatorial methods from NIST, industry, and others
  - Members short courses, workshops, demonstrations
  - Members web-site for bulletin board, preprint service, speakers list, etc.

- **Focused Projects**
  - Non-proprietary projects on new methods and applications in areas of interest to participants
  - Topics chosen by member companies in cooperation with NIST technical teams
  - Closed semi-annual meetings; No proprietary information disclosure; All research results publishable
  - Administrative support from NCMS

- **Partner memberships**
  - CRADA's partnerships with individual member organizations
  - Develop methodology and applications to problems of mutual interest
  - Projects may involve proprietary information and materials under I.P. agreements
  - Coordination support from NCMS

NIST Combinatorial Methods Center, NCMC



Building a research project around a technical issue

NCMC Participating Membership

Description: Members will be invited to attend semiannual technical meetings where combinatorial research on materials science will be presented.

Quarterly, members-only meetings will provide focused short courses, workshops or demonstrations.

Members will have access to a web-site for bulletin board, preprints, and speakers information.

Membership is for one year, renewable on a yearly basis.

New members may join at any time.

No proprietary information will be disclosed.

The NCMC will provide administrative support for organization of the meetings and Member services.

Member fees: $10,000 U.S. per Member per year. NIST reserves the right to lower this fee.

NCMC Focused Projects

Description: Members will develop combinatorial projects in areas of joint interest coordinated by NIST technical teams.

Projects will not involve any proprietary information or materials and all results will be publishable.

The NCMC will provide administrative support for projects. Membership is for one year at a time, renewable on a yearly basis.

There is no restriction on the number of projects that a Member may join or when Members may join any project(s).

Each project will be for one year, renewable for additional years.

Closed semi-annual meetings held in conjunction with the Participating membership semi-annual meetings to discuss progress on projects.

Additional meetings can be scheduled by NIST technical teams.

Participating membership is required.

Member fees: To be decided by project team.

NCMC Partner Memberships

Description: CRADA partnerships with individual member organizations will be established.

The purpose is to develop combinatorial methodology and materials properties measurement techniques and apply to materials science problems of mutual interest.

Projects may involve proprietary information and materials under intellectual property (I.P.) agreements.

The coordination of the CRADA and administrative support will be provided by NCMC.

Each CRADA project will be subject to a separate agreement regarding Statement of Work (SoW), fees (if any), proprietary information and I.P. rights. Participating membership is required.

Member fees: To be decided by individual CRADA team.

NCMC Workshops and Outputs

Participating Members

- Technical workshops with NIST updates and new directions
- Reviews of current advances elsewhere, external speakers and literature reviews
- Member input for future directions and needs assessment
- Hands-on laboratory demonstrations and testing

Example: Library preparation

- Details of preparation methods
- Designing variations in parameters
- Successes and failures
- Constraints
- Automations

In the future: Adhesion, Robotics and Programming, Informatics, Data Standards, Optical Properties, Electric Properties, Mechanical Property Tests, Bio-Responses, Solutions/Suspensions, Ink-Jetting, Spectral Imaging, Visualization of Data/Information

Variations:

- Composition
- Thickness
- Temperature
- Surface energy
- Crosslinking
- Roughness
- Phase separation
- Domain size
- Crystallinity
- Additives
- Reactivity rates

Focused Projects

- Specific topic meetings with project members for direction and reporting

Non-Travel Mechanisms for participation and dissemination

NCMC - Internal Issues

Provide coordinated outreach for NIST Labs research activities using and supporting combinatorial methods for chemistry and materials science

- Participating Membership
  - Fee pays for administrative support to organize meetings, provide web site, make connections between NIST researchers and potential customers, prepare and distribute informational materials.
  - Charging a fee produces a measure of “buy-in” from industry or other partners, assures that someone at the company will have and take responsibility for coordinating interactions with appropriate people inside the company even as these people change.
  - “Membership” also brings the activity to a higher level of recognition within the company
  - The level of buy-in should also increase credibility of effort within NIST

- Focused Projects
  - These projects could be very similar to many current research collaborations
  - Within the center there would be a standard agreement with few options (fee, in-kind, period of performance, participants, statement of work). This should greatly reduce the burden of setting up these agreements by removing many items from the table.
  - By keeping the work non-proprietary we can include universities as partners, and we can include guest researchers on the project team.
  - By keeping the work publishable we are more likely to meet the standards of pre-competitive and broadly applicable research. This will also help us attract good scientist to work on the projects.
  - In addition to providing administrative support to these projects, being associated with the center should provide synergies as part of a bigger activity.

NCMC - Internal Issues

Partner memberships

- CRADA's can be established much as is currently done
- Most are with individual companies
- If we can provide a framework agreement it may help facilitate and it could provide a standard solution for the relationship with other center activities
- For multi-company agreements it might be best to have a standard initial agreement
- Coordination support could be provided

Example issues and straw men

- Center membership $10K (associate membership at lower level for small companies who would like to provide research support)
- Focused projects could charge fees as the participating OU's choose or not charge at all
- Depending on the level of support from the center focused projects could contribute a modest amount. (The benefits of this charge mirror the benefits described for external.)
- Potential focused project topics: frame retardants, adhesion measurements, nucleation in polyolefins, ink jet library preparation, fillers effects on polymer blends
- Potential workshop topics: ink jet library preparation, spectral imaging, thermal measurements, connections to pharma, data management strategies, data visualization

Early Work on the Grand Canyon